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RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)							DATE February 1999			
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-Wide/BA 3					R-1 ITEM NOMENCLATURE Automatic Target Recognition PE 0603232D8Z					
COST (In Millions)	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	Cost to Complete	Total Cost
Total Program Element (PE) Cost	5.904	5.010	7.775	7.588	4.709	4.795	4.896	4.999	Continuing	Continuing
ATR/P232	5.904	5.010	7.775	7.588	4.709	4.795	4.896	4.999	Continuing	Continuing

(U) A. Mission Description and Budget Item Justification

(U) BRIEF DESCRIPTION OF ELEMENT:

(U) Automatic Target Recognition (ATR) systems improve the capabilities of our armed forces by enabling them to make better use of the information provided by such military sensor systems as radar, laser, infrared (IR), hyperspectral, identification friend or foe (IFF), and electronic signal measurement (ESM). ATR enhances the combat capabilities of our forces by increasing the lethality and survivability of our weapon systems and decreasing the time required to acquire and identify potential adversaries. ATR technology reduces our risk of fratricide by augmenting combat identification systems to improve our ability to distinguish between friend, foe, or neutral forces under high stress conditions. When coupled to appropriate sensor suites, ATR allows rapid detection of individual surface and buried mines and unexploded ordinance (UXO). ATR technology provides significant workload reduction for the intelligence forces by aiding the image analyst to exploit imagery rapidly and accurately. In an era of decreasing military manpower, improved ATR will enable our forces to handle an ever increasing load of sensory information in the complex situations to be encountered in the military missions of the future.

(U) Increasing ATR operational effectiveness requires research and development to enhance sensors and algorithm processing. Additionally, improved, standardized procedures and metrics for measuring and demonstrating ATR effectiveness must be developed. The utility of ATR is highly dependent on the quality of the information provided by the sensor system(s) and the ability to process that information effectively to provide reliable decisions with operationally acceptable false alarm rates. Service and Agency ATR efforts have concentrated on algorithm development for conducting post-processing comparison and decision making which exploit improved digital computational capability. This program will focus on determining effectiveness of ATR, establishing benchmark metrics, and conducting and collecting single and multi-sensor data for potential reuse in Service and Agency algorithm development and objective evaluation. Consistent with the 1997 report of the Defense Science Board Task Force on ATR, this program will establish standard tests and procedures to provide an “honest broker” assessment of current leading candidate ATR’s, as well as emerging ATR technology for the next generation of ATR systems.

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(U) The ATR program funds the integration and demonstration of advanced technology for field experimentation and assessment. The result of the ATR program efforts is the integration of the demonstrated technological capabilities and the capability to assess algorithms and various technologies. This leads to greatly improved understanding of the Joint Warfighting utility when assessed in realistic operational contexts. The Military Services provide air, land, and naval technological superiority, respectively, and ACTDs rapidly prototype and transition technological solutions to specific threat scenarios. This program provides timely resources and flexibility to horizontally integrate technology solutions across Services and Agencies and identify new and emerging “best-in-class” ATR systems with confidence so that this critical technology can be fielded sooner.

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(U) **Project Number and Title: P232 ATR**

(U) **PROGRAM ACCOMPLISHMENTS AND PLANS:**

(U) **FY 1998 Accomplishments:**

(U) Work continued to assess key ATR metrics to find the “best in class” and spur fielding for critical needs identified by the Defense Science Board (DSB) and Joint Requirements Oversight Council. An ATR Transition Conference was held to address a DSB recommendation to bring developers and operators together to better understand each other’s perspectives and expectations for ATR. The Virtual Distributed Laboratory (VDL) was brought on-line with the central site at Air Force Research Laboratory, Wright Patterson AFB, OH. The VDL is a high-speed network to Service sites to host test procedures, data sets, and ATR results to reduce the cycle time for ATR development and evaluation. A cooperative multi-sensor data collection, referred to as the Mother-of-All Data Collections-1 (MAD-1), was conducted at Eglin AFB, FL in conjunction with the Air Force, Army, and DARPA. The imagery of operationally deployed target sets was used to assess Laser Radar ATR performance and is being hosted on the VDL to mature surveillance and attack ATR algorithms. The longer-term approach to provide imagery to ATR’s for evaluation is to use multi-sensor synthetic imagery. For the first time, synthetic infrared imagery was input to an ATR for evaluation and its results were compared to those obtained with the corresponding real imagery as an initial step for validation. The recommendation of the OSD Hyperspectral Imaging (HSI) Integrated Product Team (IPT) to establish a Hyperspectral Technology Assessment Program was implemented. The Hyperspectral Technology Assessment Program (HTAP) will lay out the framework needed to characterize the potential value of HSI systems to DoD operations, and will apply this framework to identify opportunities for near-term technology development and demonstration. (\$5.904 Million)

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(U) FY 1999 Plans:

(U) The focus of the ATR assessment technology program will be directed toward Synthetic Aperture Radar (SAR) ATR for the reconnaissance and surveillance scenario. A comparative assessment of ATR's for SAR will be conducted and the results used to both establish the state-of-the-art performance and to assess concepts for performance benchmark metrics. Techniques and metrics to quantitatively describe input image difficulty, or clutter, will be developed. The program will cooperate with a service Program Manager to facilitate transition of an ATR application through enhanced evaluation techniques directed toward mission specific problem sets. "Best Practices" for standardized ATR evaluation and assessment will be established and promulgated through the Automatic Target Recognition Working Group (ATRWG). ATR evaluation techniques will be applied to hyperspectral imaging systems. The use of synthetic imagery for forward-looking infrared (FLIR) ATR evaluation will be validated. Humanitarian Demining Operations will be addressed through evaluation of ATR technologies developed to detect mines and UXO. More extensive multi-sensor algorithms will be evaluated. For HTAP, the two most promising application domains to pursue are 1.) tactical target detection and classification; and 2.) battlespace environment characterization, from both airborne and spaceborne sensors. Hyperspectral algorithm assessment and performance modeling will be undertaken for these two domains. (\$5.010Million)

(U) FY 2000 Plans:

(U) Standard metrics to describe ATR performance and associated problem sets will be adopted which cover surveillance, weapon, and attack applications of ATR's. The evaluation effort to determine "best in class" will be expanded to include more complex ATR functions such as scene analysis, and new sensor types to include hyperspectral and multi-mode sensors. Quantitative performance for hyperspectral algorithms will be established and used to refine a system level performance model. The Services' synthetic image generation capabilities will be applied to multi-spectral ATR's as a means to assess ATR performance over a wider range of operating conditions. During this time period more extensive subsystem technology effectiveness demonstrations will be conducted which support a broader range of system/platform applications. Modeling and simulation tasks will be conducted to provide software and hardware in the loop effectiveness analyses refine design requirements and manufacturing approaches. These models and simulations will be used to expand the range of tests and provide greater confidence in ATR field tests, which are limited in scope and duration, to facilitate transition to production programs. A quantitative understanding of HSI performance and operational utility will be established as a basis for future investment decisions. This timing is consistent with the current schedules for ASRP flight demos and launches of Warfighter -1 and the Navy Earth Map Observer. (\$7.775 Million)

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(U) **FY 2001 Plans:**

(U) Robustness of selected ATR's will be assessed over a wider range of challenging operating conditions using innovative applications of real, hybrid and synthetic imagery. This effort will support the validation of using multi-spectral synthetic imagery generated "on-demand" for the selected ATR in its operational scenario. The application of such multi-sensor synthetic imagery in High Level Architecture (HLA) simulations will be assessed as a technique to determine dynamically ATR effectiveness. In the hyperspectral area, an end-to-end performance model, incorporating sensor and processor models, will be validated. The end-to-end model will be used to conduct performance and subsystem trade off analyses between hyperspectral sensors and their ATR's. Service models developed to predict ATR performance will be refined to include evolving high fidelity multi-mode sensors. (\$7.588 Million)

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(U) B. <u>Program Change Summary</u>	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>Total Cost</u>
Previous President's Budget	6.487	5.081	4.909	4.725	Continuing
Appropriated Value	6.789				Continuing
Adjustments to Appropriated Value					
a. Congressionally Directed undistributed reduction	(0.302)	(.071)			
b. Rescission/Below-threshold Reprogramming, Inflation Adjustment					
c. Other			3.000	3.000	Continuing
Current President's Budget	5.904	5.010	7.775	7.588	Continuing

Change Summary Explanation:

(U) **Funding:** FY 1999 changes are due to congressionally directed undistributed reductions. FY2000 and FY2001 changes are due to addition of Hyperspectral Imaging and systems applications to the ATR Program.

(U) **Schedule:** Not Applicable

(U) **Technical:** Not Applicable

(U) **C. OTHER PROGRAM FUNDING SUMMARY COST:** Not Applicable

(U) **D. ACQUISITION STRATEGY:** Not Applicable

(U) **E. SCHEDULE PROFILE:** Not Applicable

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